

PROJECT SUMMARY

County: **Many, all Sierra Nevada region**

Applicant: **University of Nevada, Reno; Principal Investigator; Edward P. Kolodziej**

Project Title: **Evaluating Steroid Hormone Occurrence, Fate, and Transport in Grazing Rangelands in the Sierra Nevada Region**

PROJECT GOAL

The goal of this project is to assess the potential for steroid hormones excreted by grazing livestock to adversely impact surface water quality in the Sierra Nevada Region.

PROJECT SCOPE

The proposed project will use a series of laboratory, plot scale, and field scale experiments to assess the occurrence, fate, and transport of steroid hormones that enter surface waters from grazing livestock. To assess water quality impacts from animal agriculture operations to affect surface waters, I have been studying steroid hormone occurrence at large dairies and rangelands in California since 2001. I observed elevated concentrations of naturally produced estrogenic steroids in over 80% of creeks in grazing areas where cattle have access to streams for drinking water, indicating that direct discharge of wastes from a relatively small number of animals can affect water quality. However, only about 10-15% of these creeks had steroid concentrations that were high enough to potentially cause endocrine disruption in sensitive species of fish such as trout, although the causes for the higher steroid concentrations observed in these creeks is unknown. Therefore, I would like to evaluate what characteristics or management actions on grazing rangelands are controlling the concentrations of steroids in these creeks. For example, why were the steroid concentrations higher in those 10-15% of creeks where we might expect adverse impacts on fish? Were factors such as animal density, age structure, sex, or usage patterns responsible for the higher concentrations, or were these concentrations due to factors such as stream fencing, riparian buffer strips, or wetlands? Do rangeland management actions impact steroid concentrations?

I hypothesize that a well-managed grazing rangeland can control the release of steroids by exploiting attenuation processes that occur naturally in the environment. For example, current Best Management Practices (BMPs) as simple as riparian fencing or buffer strips may be enough to prevent the transport of synthetic steroids to receiving waters. If this hypothesis is true, it may be possible to optimize the use of these management strategies to prevent the release of large quantities of endogenous and synthetic steroids to surface waters and protect aquatic ecosystem health.

To answer these questions and to assess the potential for endocrine disruption in the Sierra Nevada Region, we must first understand the basic behavior of steroids when these compounds enter the environment. The first portion of this proposed study will determine what processes degrade and transform steroids when they enter the environment using a series of laboratory experiments. The second portion of this proposed study will evaluate the transport and fate of steroids at the plot and field scale using controlled experiments conducted at the Sierra Foothill Research and Extension Center in Browns Valley, CA. At this agricultural research facility, studies can be conducted that manipulate rangeland characteristics and conditions to identify rangeland conditions and management practices that best protect water quality. These experiments, along with the results of the laboratory studies, will allow us to predict steroid behavior under conditions typical of California rangelands in the Sierra Nevada

Region and to identify rangeland conditions that result in increased steroid transport to surface waters. Finally, the predictions of steroid behavior as a function of rangeland risk factors will be evaluated by collecting and analyzing water samples on operational ranches throughout the Sierra Nevada Region. The collection of samples from a variety of field sites will be accomplished with the support of the county extension advisors affiliated with the UC Cooperative Extension system. Along with the evaluation of endocrine disruption potential, these approaches also will identify watersheds at high risk for water quality impacts and management practices best protective of water quality.

LETTERS OF SUPPORT

One letter of support from Arthur Craigmill, Director of the University of California Sierra Foothill Research and Extension Center (SFREC) is attached. As part of this project, plot and field scale studies would occur at SFREC, located in Browns Valley, Yuba County, CA.

SNC PROJECT DELIVERABLES AND SCHEDULE

DETAILED PROJECT DELIVERABLES	TIMELINE
Project Start	3/01/2009
Task 1	3/2009-3/2010
Task 2	7/2009-6/2011
Task 3	4/2010-2/2012
Progress Report 1	9/2009
Progress Report 2	3/2010
Progress Report 3	9/2010
Progress Report 4	3/2011
Progress Report 5	9/2011
Final Report	2/29/2012

SNC PROJECT COSTS

PROJECT BUDGET CATEGORIES	TOTAL SNC FUNDING
Personnel (PI, Graduate/Undergraduate students, Technician)	\$92,050
Fringe Benefits, Personnel	\$12,950
Travel	\$10,500
Supplies	\$24,000
Tuition and Fees	\$6,500
Total Direct Costs	\$159,000
Indirect Costs (15% of Direct)	\$20,925
SNC GRANT TOTAL	\$179,925